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The other side of the medal

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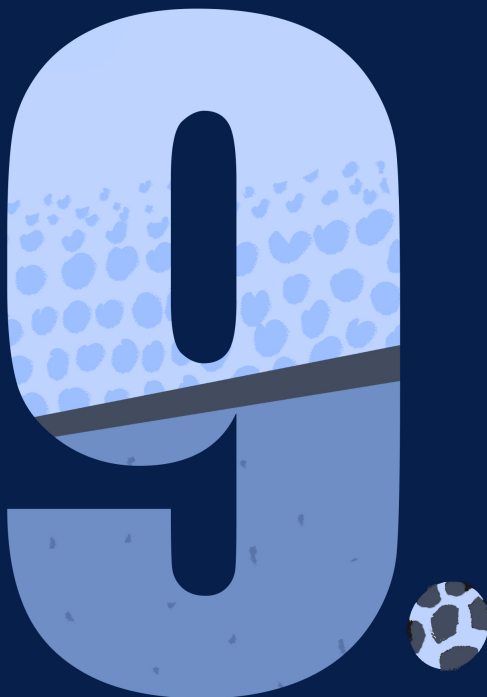
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CHAPTER 9

Summary

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Until now, long-term health issues in elite athletes received little attention in sports medicine research. This is an important gap in the literature, as it is known that certain sport-related injuries may predispose elite athletes to adverse long-term outcomes. Particularly scant information is available on long-term health in retired elite female athletes. In order to delay or even prevent long-term health issues in this population, more knowledge about post-career health is needed. Therefore, the aim of my PhD thesis was to analyse the prevalence of long-term health problems and associated risk factors in retired female football players. While chapters 2 and 3 are focused on musculoskeletal health, chapters 4 to 7 investigate cognitive health.

The burden of osteoarthritis

The most important finding of this thesis regarding musculoskeletal health was the high prevalence of osteoarthritis (OA), particularly of the knee, among retired female football players at a young age. In a sample of retired players aged 33 years on average (SD=6.2; response rate=62%; chapter 2), a quarter of participants reported physician-diagnosed OA, with the knee most frequently affected (13.8%). Moreover, a striking 57.9% had knee problems while exercising, over a third had problems during normal daily activities and almost a quarter had complaints even at rest. In a clinical follow-up investigation (chapter 3), more than half of players had MRI-evidence of substantial meniscal and/or chondral damage. Unsurprisingly, overall health perception and knee-related quality of life (QOL) was significantly worse in female football players than in the general female population of the same age group. Further, significantly more disability due to knee problems was reported by retired female compared to retired male football players ($p<.05$ for pain, symptoms and QOL subscales). These

results are troubling, especially given the young age of the sample, the significant impact on QOL and the predicted increase of OA prevalence with age (odds ratio: 1.07). It is clear that the burden of OA in the aging female football player is immense and needs addressing.

Cognitive health, concussion, and heading

The most important findings of this thesis regarding cognitive health were that retired female football players performed significantly better than the norm population on tests of general neurocognitive function, yet worse than retired elite athletes from non-contact sports on tests of verbal memory and fluency. Lower verbal memory scores were associated with frequent heading, while lower verbal fluency scores were associated with a history of multiple concussions. Significant differences on neurocognitive measures of memory performance were corroborated by a higher prevalence of self-reported memory problems in retired female football players (64%) compared to non-contact sport controls (40%). However, in other test domains no significant differences compared to non-contact sport controls were found and prevalence of clinically relevant impairment as assessed by composite memory performance was low; relative to age-matched general population values, only 15% of female football players scored below the 25th percentile, while only 2% scored below the 9th percentile. Moreover, chapters 5 and 7 revealed that on average, female football players had superior neurocognitive test values compared to the general population and no differential aging effect was found. This means, results indicated that age-related neurocognitive changes in female football players were comparable to those of the general population in a sample spanning almost four decades (15-50 years). Thus, the benefits of sport participation seem to outweigh adverse effects on cognitive performance in female football players up to middle age.

How to play the long game

Overall, the results of this thesis highlight the need to improve post-career health among retired female football players. This is especially important with regards to adverse long-term musculoskeletal health outcomes, such as OA and physical complaints. While adverse long-term cognitive health outcomes are less certain, strategies preventing or mitigating the effects of repetitive concussive and subconcussive head impacts in female athletes are still of utmost importance. Primary prevention strategies for musculoskeletal outcomes should focus on better implementation of and adherence to existing, effective prevention programs for lower extremity injuries. Primary prevention strategies for cognitive outcomes, particularly in female athletes, may benefit from the development of a neck muscle activation and strengthening program. Secondary prevention may be aided by tailoring return to play protocols to female players specifically, given the differing recovery periods and re-injury rates between the sexes. In the context of tertiary prevention, an end of career health examination with regular follow-ups may significantly improve post-career health through earlier detection and better management of long-term health issues.

The two sides of the medal

The aim of this thesis was to shed light onto the potential negative consequences of a career in contact sport. Yet, it is important to bear in mind that sport also has numerous beneficial health effects and is to date likely the single best medicine for human longevity from both an individual as well as public health perspective. Thus, the message that I would like the reader to take home from this thesis is not that elite sport is an overall health hazard, but that there are *two sides* of the ‘medal’. There is a startling divide between the availability and quality of medical care for active compared to retired athletes. As outlined above, primary, secondary and tertiary intervention strategies can and should be employed to significantly improve post-career health in elite athletes.